Homestead TES Plants Analysis:

Biological Assessment for Threatened and Endangered Plant Species and Biological Evaluation for Sensitive Plant Species

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Reported mileages are estimates and may vary depending on how they are rounded and what models and equations they are used for or result from.

Issues Addressed

This report analyzes the potential effects of the implementation of the Proposed Action (See Homestead EA) to federally-listed threatened and endangered plant species and Forest Service Region 1 sensitive plant species (together referred to as TES plant species) with the potential to occur within the project area. U.S. Fish and Wildlife Service (USDI 2017) currently lists two plant species as threatened for the Idaho Panhandle National Forests: Water howellia (*Howellia aquatilis*) and Spalding's catchfly (*Silene spaldingii*); no endangered species are currently listed. No habitat for these two threatened species occurs within the project area; therefore, the project would have no effect on T&E species. Surveys of high quality plant habitat in the Homestead project area were conducted (2017-18); no sensitive species occurrences were documented in or near areas of proposed activity. Should any TES plant sites be found in project activity areas in the future and deemed necessary to ensure population viability and prevent a potential trend toward federal listing, those sites would be protected.

Methodology

The spatial boundary for analyzing the cumulative effects to TES is the project area, which comprises three watersheds (Upper, Middle, and Lower Marble Creek; see Map 1, below). The temporal boundary for short-term cumulative effects spans from time of implementation to five to eight years thereafter; long-term effects may persist ten or more years following implementation. While effects from proposed activities may still be apparent after 50+ years, predicting effects to botanical resources beyond this time frame is too speculative to be reliable.

Resource Indicators and Measures

The indicators and measures in Table 1 are used to quantify the anticipated effects of the Proposed Action. Specifically, effects are evaluated based on the number of sensitive plant occurrences and acres of suitable sensitive plant habitat affected by the Proposed Action, and the expected responses of target sensitive species to the proposed activities. The biological evaluation determination category is the product of the role or importance of affected occurrences to persistence of the overall population together with the affected species' expected response to the disturbance in question.

Areas proposed for timber harvest or roadwork would undergo changes in canopy structure and cover, soil nutrient composition and structure, and associated moisture regimes. Because these factors are important in determining the quality of plant habitat, these analysis indicators can be used to quantify impacts to sensitive plant habitat.

Table 1. TES indicators and measures for assessing effects

Resource Indicator	**Measure**	**Used to address P/N or key issue?**
Sensitive plant occurrences	Number of occurrences affected	No
Sensitive plant habitat	Acres of sensitive plant habitat affected (soil disturbance, changes in canopy cover)	No
Sensitive plant responses to the proposed activities	Determination category for sensitive plants	No

Degree of impact is measured as very low to high—depending on whether or not any measurable effects would take place, the scale at which impacts would occur (individual, population, or habitat-level), and whether or not these would likely affect long-term habitat capability or populations (Table 2).

Table 2. Terminology used to describe magnitude of effects

Degree of impact	**Description**
Very low	No measurable effect on individuals, populations, or habitat.
Low	Individuals, populations, and/ or habitat not likely affected.
Moderate	Individuals and/ or habitat may be affected, but populations would not be affected. Over the long term, habitat capability would not be reduced to below a level that could not support sensitive plant species.
High	Populations may be affected and/ or habitat capability would be reduced to below a level that could support sensitive plant species.

Habitat Guild Model

TES plant species have been assigned to one or more habitat guilds, which are associations or groupings of plants with similar habitat requirements: wet, moist, dry, and cold forest; and subalpine, deciduous/ riparian, peatland/ meadows, and aquatic habitats (Mousseaux 1998). The guilds have been characterized in terms of attributes like elevation, topographic features, overall vegetation community, etc. – and serve as useful analytical tools. The presence/ absence of habitat guilds in a project area can be used as a proxy for the likelihood of presence of associated sensitive plant species there. A habitat type is considered as having high potential for the presence of certain associated plants, even without actual detection of plants; evaluation of potential project effects can therefore focus on likely effects to those guilds and associated sensitive plant species present in the project area.

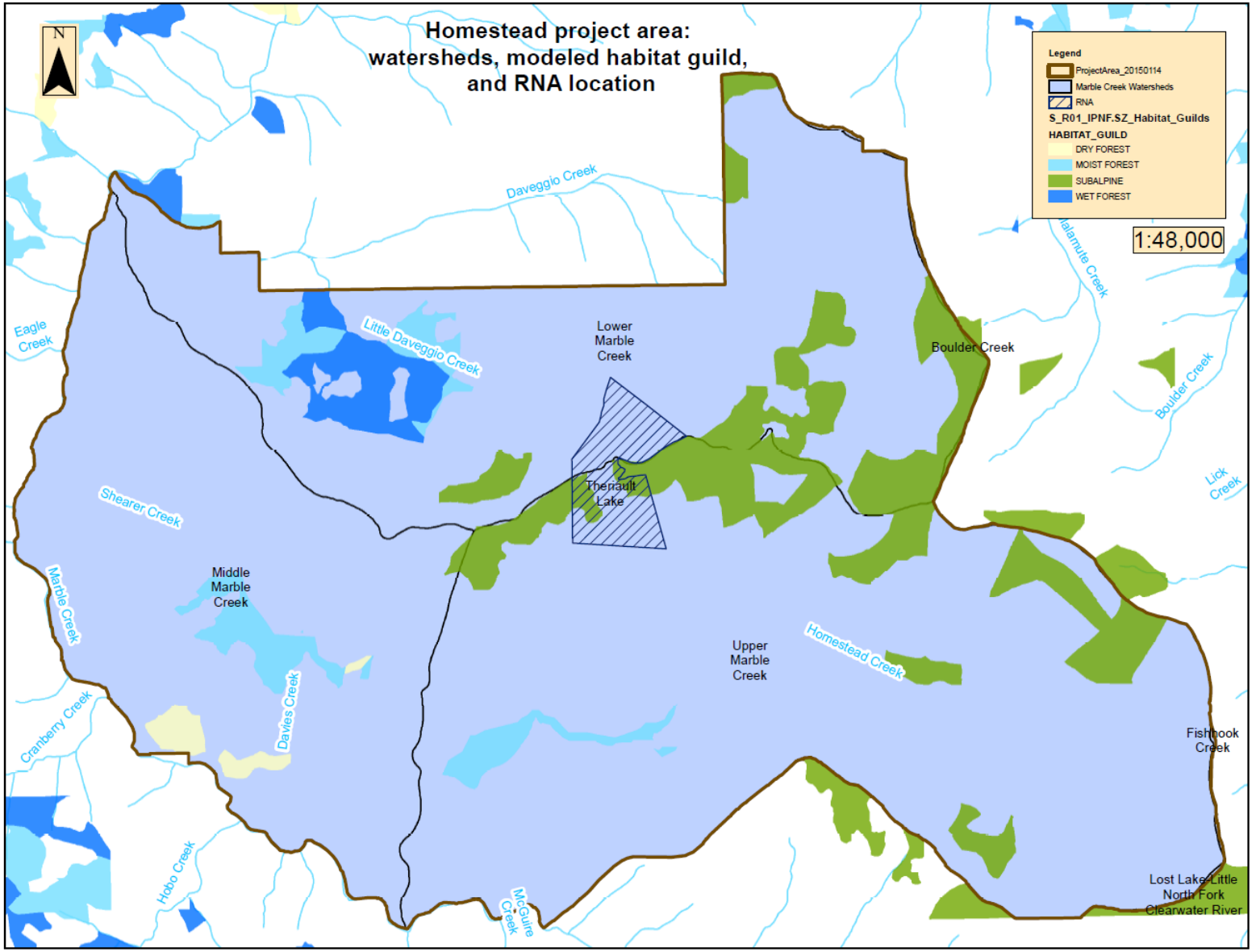
The distribution of guilds in the project area serves as a useful 'coarse filter' to predict where sensitive plant habitat may be found, but has its limitations: micro-sites and variances (like seeps, springs, rock outcrops) that can serve as sensitive plant habitat are often missed and the actual extent of suitable habitat is often over-estimated.

Other Information Sources

Other data sources used to identify sensitive plant occurrences and suitable sensitive plant habitat included aerial photos and topographical maps, the Natural Resource Information System (NRIS) database for known sensitive species' occurrence distribution on National Forest lands, queries of the forest stand and forest activities database (FACTS), Idaho Fish and Game Conservation Data Center database for element occurrence records (ICDC 2018), National Wetlands Inventory Maps, and pertinent scientific literature (e.g., regarding target species and/ or natural histories of the area). There are limited data regarding the historical abundance and distribution of sensitive plants within the project area. This is because, prior to 1988, surveys for sensitive plants did not take place regularly and occurrence reports were sent only incidentally to the ICDC.

For many species, scientific data identifying factors important to species' persistence are few or lacking (Halpern and Spies 1995). In some cases, informal observations are available, but these may not be generalizable to all situations in which these plants occur. Relevant scientific literature and monitoring reports exist for several of the Region 1 sensitive species. Even with these data, it can be difficult to quantify the effects of disturbance events to sensitive populations, not only because different species' ecological requirements vary, but also because disturbance events vary in intensity and scale and interact with other existing conditions and ongoing processes and events.

Map 1: Homestead project area: Marble Creek watersheds, modeled habitat guilds, and Theriault Lake RNA



Pre-Field Review

The Homestead project area is forested, comprised mainly of mixed conifers like Western red cedar, Douglas fir, grand fir, and lodgepole pine. Pre-field review revealed documented Whitebark pine occurrences within the project area, but far from any proposed timber harvest; the nearest other sensitive plant species are found circa 9+ air miles away from the project area (NRIS 2018; ICDC 2018). Forest vegetation mapping data identified four habitat guild types as present in the project area: dry, moist, and wet forest and subalpine (refer to Map 1, above).

The proposed areas of activity (timber units, areas of roadwork) occur in areas modeled as either moist forest habitat or not identified as high quality habitat. No timber harvest is proposed within dry, wet, or subalpine habitat guilds; Whitebark pine restoration is proposed for 202 acres, largely within sub-alpine habitat. Old growth and riparian areas are excluded from the proposed action.

Field Surveys

Surveys were conducted from June to August, 2018 and in June, 2019, during a time when plants are blooming and seeding and are therefore most easily detected and identified. Surveys in proposed areas of activity varied in intensity, depending on the quality of the habitat encountered. More intensive surveys were conducted in areas of intact, high quality habitat and micro-sites that appeared to provide conditions suitable for moist forest sensitive plant species. While the Timber Stand Management Records System (TSMRS) 'coarse filter' predicted 118 acres of high quality moist forest in the project area, field surveys identified approximately 333 acres of high quality moist forest conditions (see Table 4, below). Of the total 333 acres, 101 occurred in small patches or micro-sites. Two hundred thirty-two acres occurred in larger patches.

Additionally, twenty-nine small riparian areas (e.g., seeps and springs) not predicted by the 'coarse filter model' were encountered during surveys; these ranged from ephemeral to annual streams with very low flows. These wetlands are characterized by either a very dense overstory with a sparsely vegetated understory or open canopy with dense understory. Geospatial data for these riparian areas was shared with the interdisciplinary team and added to the project database to ensure that any areas newly detected would be marked and buffered for avoidance during project implementation.

Surveys focused primarily on proposed activity areas (units and areas of roadwork), where impacts would occur; consequently, riparian areas and old growth stands, both of which provide habitat conditions associated with various forest sensitive species, were mainly excluded from survey and this may partly explain why no sensitive plant occurrences were detected. No new sensitive plant occurrences were detected during surveys. However, as noted above, suitable habitat was identified and sensitive plants may therefore be expected in the project area.

Existing Disturbances

Past activities like road construction, motorized road use, and timber harvest have impacted the project area in ways that continue to shape the quantity and distribution of sensitive plant habitat. As is the case for northern Idaho in general, the project area has a long history of land management. For example, since the 1950s, over a dozen timber harvests totaling approximately 1,950 acres have taken place in the project area (see past, present, and reasonably foreseeable future table: timber activities). Past activities have altered habitat by changing canopy structure and cover and disturbing soil, as well as by introducing non-native, invasive species that thrive in disturbed, open (sunny) conditions. Consequently, the project area is comprised of both intact, largely undisturbed native plant communities, as well as disturbed, weedy areas.

Proposed units are characterized by a dense canopy, vigorous shrub layer, and understory of mainly native forbs and grasses. For the most part, weeds are confined to old roads, trails, and open patches in the canopy (resulting from disturbance) and occur in low densities. No 'new invader' weed species were encountered in the project

area; species identified in the project area are widespread throughout the forest (e.g., *Centaurea stoebe* ssp. *micranthos, Cirsium arvense, Cirsium vulgare, Cynoglossum offinale, Hypericum perforatum*, and *Leucanthemum vulgare*). See the Homestead Weeds Analysis for further discussion of weed species' classification, their current status in the project area, and potential impacts of the proposed project to their distribution.

Current impacts to sensitive plant habitat and individual plants are related to road maintenance, recreation activities, wild animals, natural disturbances, and the ongoing consequences from past activities. Recreation activities like berry-picking, public vehicle use, hiking, camping, hunting, and firewood-cutting may result in some trampling and picking of individual sensitive plants. Wild animals are likely also trampling sensitive plants and some degree of herbivory and insect predation is occurring.

In addition to such anthropogenic impacts, natural disturbances can have impacts at the level of individual plants, as well as at the landscape or habitat level. These include events like fire and extreme weather (e.g., storms, high winds, hail, floods, landslides, and drought). Such events can cause changes in canopy cover, move soil (thereby covering or moving plants and/ or changing hydrological patterns), and introduce sudden high levels of litter (by battering the tree canopy) and new downed wood (by blowing down trees).

Overall, native plant communities and sensitive plant habitat are considered to currently experience relatively minimal impacts from ongoing activities, as these are mostly restricted to roads, trails, and adjacent areas.

Biological Assessment for Threatened and Endangered Plant Species

As directed by the Council on Environmental Quality (40 CFR 1502.2(b)), possible impacts to threatened and endangered (T&E) plants are discussed commensurate to their significance. Detailed analysis and discussion are included below for species and habitat considered to be present. U.S. Fish and Wildlife Service (USDI 2017) currently lists two plant species as threatened for the Idaho Panhandle National Forests: Water howellia (*Howellia aquatilis*) and Spalding's catchfly (*Silene spaldingii*). No species are listed as endangered for the Idaho Panhandle National Forests at this time.

Both threatened species are documented as present in Latah County and may occur on the Idaho Panhandle National Forests. Field botanical surveys for these species have been conducted in potentially suitable habitat on the Idaho Panhandle National Forests; however, to date, no occurrences have been documented

U.S. Fish and Wildlife Service (USDI 2017) currently lists Whitebark pine as a candidate for federal listing; given this status, the regional Forester has designated Whitebark pine as a sensitive species. Whitebark pine is associated with alpine and sub-alpine habitat. Approximately 2,067 acres of sub-alpine habitat are found in the project area and a few Whitebark pine trees have been documented. No timber harvest or roadwork is proposed in sub-alpine habitat in the project area; however, the Proposed Action includes restoration activities (e.g., prescribed burning, hand thinning, planting) to benefit Whitebark pine for 202 acres of sub-alpine habitat. Because it is managed as a sensitive species, potential effects to Whitebark pine are discussed below.

Direct, indirect, and cumulative effects under the No-Action alternative

Under the No-Action alternative, none of the proposed activities would take place. Ongoing and future authorized activities would continue as planned.

There would be no direct or indirect impacts to T&E plants or their habitat, because none of the proposed activities would take place. Furthermore, because there is no suitable habitat for threatened species in the project area and because no endangered species are currently listed for the Idaho Panhandle National Forests, no cumulative effects to T&E species would occur.

Direct, indirect, and cumulative effects of the Proposed Action

Because there is no suitable habitat for threatened species in the project area and because no endangered species are currently listed for the Idaho Panhandle National Forests, no cumulative effects to T&E species would occur under the Proposed Action.

Biological Evaluation for Sensitive Species

This analysis concerns itself with species for which effects are possible as a result of the Proposed Action; where no effects are expected, species are not analyzed further. Consequently, as explained below, the following analysis focuses exclusively on Region 1 sensitive species associated with the moist forest and sub-alpine guilds.

Region 1 sensitive species are species for which population viability is a concern because of current or predicted downward trends in numbers, distribution, and/ or habitat quality. Currently, thirty-two sensitive species are known or expected to occur on the St. Joe Ranger District of the Idaho Panhandle National Forests (USDA 2011). Of the various possible habitat guilds present on the forest (Mousseaux 1998), field surveys and predictive modeling identified only moist forest habitat in proposed timber harvest activity areas; fifteen sensitive species are associated with this guild (see Appendix A at end of document). Additionally, restoration treatment to benefit Whitebark pine is proposed for 202 acres of sub-alpine habitat. In addition to Whitebark pine, two other sensitive species are associated with the sub-alpine guild (see Appendix B at end of document). Effects of the Proposed Action are expected to be limited to moist forest and sub-alpine habitat guilds; therefore, analysis is limited to consideration of species associated with these two guilds.

No-Action Alternative

The proposed action and associated activities would not occur in the case of the No Action alternative. Ongoing and future authorized management activities would continue as planned.

Direct and Indirect Effects

The No Action alternative would have no direct impacts on sensitive plants or their habitat because none of the proposed activities would take place.

Proposed Action

Table 3 summarizes the Proposed Action; see Homestead EA for a more detailed discussion.

Table 3. Proposed Activities

Vegetation treatment &roadwork	Specific activities	No Action	Proposed Action
Silvicultural treatments (acres)	Even-aged regeneration harvest	0	1,170
	Commercial thinning	0	49
Fuels Treatments (acres)	Fuel reduction activities	0	1,219
	Whitebark pine restoration	0	202
Road management (miles)	New road construction	0	4
	Non-system roads to be added to NFS	0	2.7
	Temporary road construction	0	2.9
	Road reconstruction	0	5.2
	Road maintenance	0	32.7
	Road decommissioning	0	25.8
	Road storage	0	12.5
Increase in size of stockpiles areas (acres)	Location 1 (from 0.70 to 1.72 ac.)	0	1.02
	Location 2 (from 0.31 to 0.60 ac.)	0	0.29
	Location 3 (0.2 to 1.64 ac.)	0	1.44

As outlined in Table 1 at the beginning of this report, potential effects to TES plants are measured by the number of plant occurrences and acres of sensitive plant habitat affected by the proposed activities. Table 4, below, summarizes the number of documented sensitive plant occurrences and acres of sensitive plant habitat detected in the Homestead project area. Approximately 23 percent (535 acres) of the total 2,351 acres of estimated sensitive plant habitat would be affected by the Proposed Action; this includes 333 acres moist forest and 202 acres sub-alpine guild habitat.

Table 4. Botany Indicators and Measures for the Existing Condition

Resource indicator	***Resource measure***	**Existing condition**	**# Occurrences/ Acres**
Sensitive plant species occurrences	*# Occurrences in project area*	Whitebark pine	4
Sensitive plant habitat	*Acres in project area*	Dry forest	94
		Moist forest	471
		Wet forest	284
		Sub-alpine	1,503
		Total	2,351
Sensitive plant habitat affected by proposed action	*Acres in proposed activity areas*	Dry forest	0
		Moist forest	118 (333*)
		Wet forest	0
		Sub-alpine	202
		Total	535**

* GIS modeling predicted 118 acres moist forest habitat; field surveys identified 333 acres of moist forest habitat.
** Based on acres of high quality habitat as identified during surveys.

In assessing the potential impacts of the Proposed Action to sensitive plants, it is important to consider the: 1) magnitude of impact of each of the activities, i.e., based on degree of canopy removal and/ or soil disturbance (displacement and/ or compaction) involved); 2) scale of each activity (number of acres); 3) likely response of the species in question to the types of disturbance associated with the proposed activities; and 4) project- and site-level design features that would protect individual sensitive plants and/ or their habitat.

Appendix C, found at the end of this document, outlines the magnitude of impacts of forest management activities, including those found in the Proposed Action. Below, the interaction of these activities' inherent magnitude with the proposed scale (acreage of treatment units and miles of roadwork) is discussed.

Appendices A and B, found at the end of this report, summarize available data regarding habitat requirements and disturbance tolerance for the 15 sensitive species associated with moist forest and three sensitive species associated with sub-alpine habitat. Based on these data, the sensitive species can be broken into three groups: 1) some disturbance can be beneficial (contingent on scale, intensity, and frequency); 2) disturbance is not beneficial; and 3) disturbance may be beneficial, but conflicting or only preliminary data exist, so it is difficult to draw conclusions.

Sensitive species and their habitat may be directly and indirectly impacted by the proposed activities. Changes to light, air and soil temperature and moisture are examples of indirect impacts and may eliminate species with specific habitat requirements, as can disruption of soil structure and hydrology. Frequent and/ or intense disturbances may favor species tolerant of, or adapted to, disturbance (including many weed species) and may result in a decrease in species with specific substrate and micro-climatic requirements, limited dispersal rates, and slow growth. This includes species associated with mid- to late seral stages—such as mosses, lichens, and vascular plants associated with old trees and mature stand conditions (Halpern and Spies 1995: 929).

Possible direct impacts include accidental crushing or damaging of undetected plant occurrences by soil and vegetation removal, timber removal equipment and personnel, and disturbances associated with the various types of roadwork. Additionally, undetected annual plants that experience disturbance prior to seed set may experience subsequent decreased viability as a consequence of a reduced seed bank. Perennial plants may experience ground disturbance to rootstocks (rhizomes, taproots, and bulbs), potentially inhibiting the plants' ability to re-sprout from rootstock.

As described in Appendix A, moist forest-associated sensitive species **intolerant** of disturbance include: Maidenhair spleenwort, Green bug-on-a-stick moss, Clustered lady's slipper, Britton's grimmia moss, Chickweed monkeyflower, and Naked mnium moss. These species are associated with shaded, humid, mature/ old growth forested areas with continued input of decaying wood—as well as with micro-sites like rock cliffs and outcrops or seeps within moist and wet forest conditions. On the other hand, other moist forest sensitive species may benefit from the proposed shift in forest composition and structure toward the desired condition, as periodic disturbance provides for the maintenance of important components of their habitat. Deer fern and six of the sensitive Moonwort species fall into the category of **tolerant** of, and **potentially benefiting** from, some level of disturbance. Two species for which there is currently less information, Constance's bittercress and Idaho barren strawberry, *may* tolerate and benefit from disturbance, but further data are necessary in order to identify the degree and type(s) of disturbance that can influence these species' success (Lichthardt and Mosely 1994: 21).

As described in Appendix B, two of the three sub-alpine sensitive species—Whitebark pine and Leafless bug-on-a-stick—are thought to benefit from some type(s) of disturbance. While taxon-specific data regarding variables important to Sticky asphodel's success are lacking, given its narrow (peatland) habitat requirements, it is likely that this species is intolerant of changes to local hydrology, as is documented for other species in this genus.

Project design features

The Proposed Action includes project- and site-level design features designed to protect sensitive plants. For any additional sensitive plant occurrences identified during project implementation, an agency botanist would be contacted and an assessment conducted in order to determine appropriate management prescriptions. These might include: 1) modifying activity methods to protect rare plants and their habitats or otherwise modifying the proposed activity, and/ or implementing spatial buffers around plant occurrences.

Additionally, provisions for the protection of Endangered Species and settlement for environmental cancellation would be included in all contracts as specified under Timber Sale Contract provisions B6.24, Protection Measures Needed for Plants, Animals, Cultural Resources, and Cave Resources; C6.24#- Site Specific Special Protection Measures; and B8.33, Contract Suspension and Modification.

Finally, design features related to soils and hydrology, developed to minimize soil displacement and compaction and exclusion of riparian areas from treatment, would also serve to benefit individual sensitive plants and their habitat. See the Homestead EA for a complete list of design features.

Direct and indirect effects of the proposed activities

Silvicultural treatments

The Proposed Action includes 1,170 acres of regeneration harvest, including 7 openings greater than 40 acres (totaling ~970 acres), and 49 acres of commercial thinning. As described in Appendix C, regeneration harvest involves removal of most (~90%) of the canopy cover, leaving scattered groups and individual trees standing. The more canopy that is removed, the greater the magnitude of effects (i.e., changes to light/ shading, temperature, soil and air moisture, and wind). Therefore, regeneration harvest is considered to have a moderate direct and indirect impact to sensitive plants and their habitat, respectively. Because much less canopy is removed and habitat

conditions remain similar to pre-treatment conditions—and because relatively few acres are proposed for treatment, the 49 acres of commercial thinning pose a short-term low risk to sensitive plants and their habitat.

The proposed regeneration harvest would likely convert the 1,170 acres to early seral status, as a result of the increased solar insolation and wind and attendant higher air and soil temperatures and lower humidity and soil moisture resulting from this treatment. Weed species would thrive in such conditions, providing one challenge to reestablishment by native moist forest species (see Homestead Weeds Analysis). Additionally, research has shown that altered temperature, wind, and moisture can affect animal-plant interactions in a way that negatively impacts plant populations' persistence on the landscape. Jules and Rathcke (1999), for example, found a correlation between reduced recruitment of *Trillium* sp., a long-lived herbaceous perennial, and proximity to forest edge. They identified two mechanisms for this trend: 1) decreased seed production because of changes in pollination dynamics (reduced visits from pollinators) and 2) increased seed predation by rodents, which were found to be present in much greater numbers in clearcut areas (e.g., Mills 1996). The 40+ acre openings may further exacerbate such dynamics, although the individual trees and groups of trees left in units may compensate to a degree (i.e., as sources of shade/ ameliorated conditions and seed).

In the long term, moist forest sensitive species adapted to shorter cycles of disturbance may benefit in treated areas, as the proposed activities change the existing condition to a more desirable condition (i.e., trending forest composition, structure, and patterning for the warm/moist biophysical setting toward the desired condition, FW-DC-VEG-11). This includes 9 of the 15 moist forest associates, specifically, Deer fern, six Moonwort (fern-like) species, Constance's Cardamine, and Idaho barren strawberry; see Appendix A for a more detailed description of these species' tolerance of and need for some type(s)/ levels of disturbance. On the other hand, moist forest sensitive species associated with shadier, cooler, and more humid mid- to late-seral state stand conditions would not experience such beneficial impacts.

Yarding (logging) systems

The Proposed Action includes 918 acres of ground-based yarding, 213 acres of skyline yarding, and 88 acres of off-road skyline yarding. As outlined in Appendix C, ground-based yarding poses a risk of moderate to high direct and indirect impacts to sensitive plants, as a result of associated soil disturbance, disruption, and compaction. Soils design features, including winter harvest (i.e., on frozen ground only) can ameliorate some of these effects, decreasing the risks of more severe soil displacement and compaction (e.g., rutting), which can alter soil structure and hydrology, as well as of direct damage to individual plants. The risk of this method can thus be lowered to low-to-moderate. Soils design features #1 and #2 (in Appendix D of the Homestead EA) require winter harvest and cessation of harvest under thawing conditions; these would reduce the risk of ground-based harvest to moderate.

Roadwork and rock storage locations

Table 3 outlines the roadwork proposed to provide access to timber harvest units. In addition to the construction of temporary and new roads and the maintenance and/ or reconstruction of existing roads, the three rock stockpile locations would be expanded to accommodate the rock needed to prepare roads for timber hauling and associated project activities.

Indirect impacts to sensitive plant habitat include canopy removal, soil disturbance, soil compaction, and the introduction/spread of invasive weed species. However, because existing road corridors, which characterized by ongoing disturbance from vehicles and higher wind (than in intact forest), do not constitute high quality sensitive plant habitat, and because surveys were conducted along proposed new/ temporary roads, direct impacts to sensitive plants would not be expected from the proposed roadwork. Similarly, the proposed rock storage areas would be located in existing disturbed roadside sites, thus, direct impacts to sensitive plants are unlikely.

Appendix C outlines the magnitude of impact associated with the different types of roadwork, which range from low to moderate. The 4 miles of new road would represent a permanent loss of habitat for native plants, whereas the impacts of the 2.9 miles of temporary road would be shorter-lived. In the long term, the proposed 25.8 miles of non-system road decommissioning and 12.5 miles of long-term storage would permit these areas to return to native vegetation. The total of 2.75 acres resulting from the expansion of the rock storage locations would represent a permanent loss of habitat for native plants, as these locations would be re-used as landings and for other purposes following project implementation (see EA for further discussion).

With respect to time frame, indirect impacts to habitat would be most acute 10–30 years following project implementation for temporary, stored, and decommissioned roads—until the regenerating tree canopy begins to provide shade and other associated conditions necessary favoring rare plant species' return. Weeds introduced through project-related activities may persist after road closure, storage, and decommissioning, so that indirect impacts related to changes in plant community composition last longer than the life of these roads. Other elements of rare plant habitat may not return for over 50 years—for instance, conditions associated with mature forest stands. Overall, given the scale of roadwork and of roadwork representing a permanent loss of habitat, the impact of this activity may be considered low.

Fuel reduction activities

The Proposed Action includes fuel reduction activities for all timber harvest units (1,219 acres). Appendix C describes the risks to sensitive plants and their habitat associated with fuel reduction activities. There is the potential for direct impacts to sensitive plants – damage or destruction of undetected individual plants – from fire and ground-disturbing activities (e.g., machine piling of slash/ debris). Indirect impacts may result from changes to canopy cover and forest floor; the degree of change (and therefore impact) depends on the intensity, scale, and timing of the fires. Moist forest-associated sensitive species are more vulnerable to the impacts of habitat change than dry forest species, as many of the former are associated with specific habitat conditions only found in mid- to late seral states (e.g., shaded, humid mature forest stands and substrates such as rotting logs) (see Appendix A for further discussion of habitat requirements of specific moist forest sensitive species).

In view of the scale of the fuel reduction activities (especially taken together with the regeneration harvest's impacts to habitat) and the vulnerability of moist forest-associated sensitive species to indirect impacts to their habitat (i.e., loss of more mature forest characteristics), the effects of the fuel reduction activities are likely to be moderate.

Whitebark pine restoration

In the case of the 202 acres of proposed Whitebark pine restoration in sub-alpine habitat, low-intensity prescribed fire would be used (in the fall, after a killing frost) to create suitable habitat for this sensitive species, specifically, by creating openings and removing competing species, thereby preparing the stage for subsequent planting of rust-resistant Whitebark pine. The low intensity of the prescribed fire would reduce the risk of direct effects to existing Whitebark pine in these 202 acres. Additionally, hand tools would be used to remove immediately surrounding vegetation. While there is a low risk of direct effects to these trees (damage or destruction), over the long term, the proposed activities would improve the suitability of these 202 acres of sub-alpine habitat for this species, allowing it to regenerate and reach maturity.

Two other sensitive species are associated with the sub-alpine habitat guild: Leafless bug-on-a-stick and Sticky asphodel (See Appendix B). Sticky asphodel is associated with wetlands, which are not present in the 202 acres proposed for Whitebark pine restoration; accordingly, there would be no impacts to this species from the Proposed Action. Leafless bug-on-a-stick is a pioneer species associated with disturbed, acid, sandy, or clayey soils. It is found on substrates such as old stumps and logs and is found along road banks and forested trails. As

such, it may be impacted by the proposed activities in the short-term, but as a pioneer of disturbed conditions, should benefit in the long term.

Cumulative Effects

Past activities/ events

Past activities in the project area include road construction, reconstruction, decommissioning, and maintenance; vegetation management including timber harvest, pre-commercial thinning, tree planting, and prescribed burns; vehicular traffic; development; and recreational uses. Together, these activities have, to some extent, decreased the overall extent of suitable sensitive plant habitat present in the project area and resulted in the disturbance and/or mortality of individual sensitive plants. Specifically, in various ways already discussed, these activities have resulted in habitat alteration and fragmentation in and around the project area. The effects from these disturbances may have reduced the number of sensitive plant occurrences or acres of suitable habitats within the project area. However, because botanical surveys were not regularly conducted on NFS lands prior to 1990, it is not possible to understand the distribution of sensitive plants at that time or the effects of past activities to them. Similarly, the effects of past activities on private lands within the project area to sensitive plants is unknown.

At the same time, activities like road decommissioning and tree planting may have accelerated the recovery of some areas toward suitable habitat conditions. Similar to the current proposal, past activities have included design features to help protect and/or mitigate impacts to rare plants.

Present, ongoing, and reasonably foreseeable activities/ events

Current, ongoing, and reasonably foreseeable activities on National Forest System lands within the area of analysis for cumulative effects would have low impacts to rare plants overall. These activities, which include timber harvesting, Travel Plan implementation, St. Joe RD weed herbicide treatment, roadwork, and outfitter guide and recreation activities are all evaluated by way of the National Environmental Policy Act (NEPA) process. Moreover, habitat assessment for TES plants is conducted for all ground and/ or vegetation disturbance on the St. Joe RD and, although some individual sensitive plants may occasionally be impacted, cumulative impacts to these species and their habitat are expected to be low. Very little private land is located within the Homestead project area, such that no to very low impacts would be likely from any development or logging activities taking place on these acres.

Determination of cumulative effects for the Proposed Action

Because no suitable habitats for the two threatened species listed for the Idaho Panhandle National Forests, Water howellia and Spalding's catchfly, the Proposed Action would have **no effect** to these species (See Table 5, below). There would be **no effect** to endangered species, as currently none are listed for the Idaho Panhandle National Forests.

Region 1 sensitive plants that occur only in cold forest, dry forest, wet forest, deciduous/riparian, peatland/meadows, and/ or aquatic habitat guilds would not be affected by the Proposed Action because these habitats are not present in areas affected by the proposed activities. Therefore, it is my determination that the Proposed Action would have **no impact** to the 19 sensitive species associated with these guilds (Table 5).

Approximately 23 percent (535 acres) of the total 2,351 acres of modeled sensitive plant habitat would be affected by the Proposed Action; this includes 333 acres moist forest and 202 acres sub-alpine guild habitat. It is possible that undetected sensitive plant occurrences would be directly affected. However, project- and site-level design features would ensure protection of any additional sensitive plants encountered during implementation and require exclusion of riparian areas and old growth stands, which provide habitat for many of the district's sensitive species; their exclusion would reduce the chance of affecting sensitive plants and their habitat.

Table 5. Summary of TES species analyzed

Species	Species &/or habitat in project area?	Species &/or habitat in project area, but not affected by Proposed Action?	Species &/or habitat in project area & potentially affected by Proposed Action?	Determination
Federally listed species (Threatened)				
Howellia aquatilis	No	No	No	No effect
Silene spaldingii	No	No	No	No effect
Region 1 sensitive species by guild				
Aquatic	No	No	No	No impact
Cold forest	No	No	No	No impact
Deciduous riparian	No	No	No	No impact
Peatland	No	No	No	No impact
Dry forest	Yes	No	No	No impact
Moist forest	Yes	Yes	Yes	MIIH*
Sub-alpine	Yes	Yes	Yes	MIIH*

* MIIH = **m**ay **i**mpact some **i**ndividual plants and **h**abitat in the short-term, but will not likely lead to a trend towards federal listing or cause a loss of viability to the population.

It is my determination that while the Proposed Action **may impact some individual plants and habitat in the short-term, it will not likely lead to a trend towards federal listing or cause a loss of viability to the population of the 15 moist forest and 3 sub-alpine habitat sensitive species** analyzed here (Appendices A and B). Taken together with the past, present, and reasonably foreseeable activities discussed above, in the short term, the Proposed Action would have **moderate** and **low** cumulative effects to sensitive plant species associated with the moist forest and sub-alpine guilds, respectively. Specifically, while the effects of individual proposed activities vary (Appendix C), the scale and intensity of effects associated with the 1,170 acres of regeneration harvest and 918 acres of ground-based yarding bring the overall effect to moderate. Finally, as discussed above, long-term beneficial effects to 2 of the 3 sub-alpine and 9 of the 15 moist forest sensitive species may be expected.

Table 6. Summary of Environmental Effects to Sensitive Plants

Resource Indicator	Measure	No-Action	Proposed Action
Sensitive plant occurrences	Number occurrences affected	0	0 (If encountered during implementation, site-specific design features would protect occurrences from direct impacts, where applicable)
Sensitive plant habitat	Acres impacted	0	Moderate short-term impacts to 333 acres of moist-forest habitat and low impact to 202 acres sub-alpine habitat. Potential long-term beneficial impacts to 535 acres.
Sensitive plants response to proposed activities	Determination category	NA	For 15 sensitive species associated with moist forest and 3 associated with sub-alpine habitat: **May impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause loss of viability to the population or species**. For 14 sensitive species not associated with moist forest or sub-alpine habitat: **No impact**.

Consistency with Relevant Laws, Regulations, and Policy

Land and Resource Management Plan

The 2015 Forest Plan (USDA Forest Service 2015) includes the following desired condition and guideline statements for TES plants:

FW-DC-VEG-09. (Desired Condition) Habitat for plant species listed under the Endangered Species Act (ESA) is maintained or restored on National Forest lands, thus contributing to species recovery or delisting. Ecological conditions and processes that sustain the habitats currently or potentially occupied by sensitive plant species are retained or restored. The geographic distributions of sensitive plant species in the Forest Plan area are maintained.

FW-GDL-VEG-07. (Guideline) Evaluate proposed management activities and project areas for the presence of occupied or suitable habitat for any plant species listed under the Endangered Species Act or on the regional sensitive species list. If needed, based on pre-field review, conduct field surveys and provide mitigation or protection to maintain occurrences or habitats that are important for species sustainability.

Along with managing for TES species as outlined above, the 2015 Forest Plan, following the 2008 planning rule and directives (FSH 1909.12, Chapter 40), also identifies FSOCs. FSOC are species for which there is concern at the planning (e.g., forest) level, even though they are considered secure at larger scales (e.g., regional, global); they are identified based on criteria outlined in FSM 1909.12_40, 43.22b and 43.22c. The 2015 Forest Plan has no direction regarding their management, in adherence with NFMA, FSOC are targeted during surveys, documented and reported when found, and addressed in environmental documents. No determination of effects is required or made for FSOC.

Other Relevant Law, Regulation, or Policy

Endangered Species Act

The purpose of the ESA is to provide a means whereby the ecosystems upon which T&E species depend may be conserved and to provide for the conservation of these federally-listed species. The ESA directs federal agencies to ensure that any actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of T&E species or result in the destruction or adverse modification of their critical habitats (ESA Section 7(a)(2)).

National Forest Management Act

The National Forest Management Act (NFMA) of 1976 is the primary statute governing administration of national forests and was an amendment to the Forest and Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on NFS land. NFMA changed forest planning by requiring the Forest Service to use a systematic and interdisciplinary approach to resource management, as well as providing for public involvement in preparing and revising forest plans. This includes a requirement that project-level planning be in compliance with the NEPA and Forest Plans.

Forest Service Manual

Forest Service Manual direction (FSM 2672.1 and FSM 2672.43) requires that proposed activities be reviewed for their potential effects on TES species and outlines policy, objectives, and procedures.

The Forest Service Manual (FSM 2670) (USDA Forest Service 2005) directs national forests to assist states in achieving conservation goals for endemic species, complete biological evaluations of programs and activities, avoid and minimize impacts to species with viability concerns, analyze the significance of adverse effects on populations or habitat, and coordinate with states and USFWS.

The Forest Service Manual (2670.15) defines sensitive species as those plant species identified by the Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trend in numbers, density, or habitat capability that would reduce a species' distribution.

FSM 2670.22 directs national forests to "maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on NFS lands." FSM 2670.32 states to "avoid or minimize impacts to species whose viability has been identified as a concern."

References Cited

Ahlenslager, K. and L. Potash. 2007. Conservation Assessment for 13 Species of Moonworts (*Botrychium* Swartz Subgenus *Botrychium*). USDA Forest Service Region 6 and USDI Bureau of Land Management, Oregon and Washington. 58 p.

Beatty, B.L., W.F. Jennings, and R.C. Rawlinson. 2003. *Botrychium ascendens* W.H. Wagner (trianglelobe moonwort), *B. crenulatum* W.H. Wagner (scalloped moonwort), and *B. lineare* W.H. Wagner (narrowleaf grapefern): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. Available online: http://www.fs.fed.us/r2/projects/scp/assessments/botrychiums.pdf

Blake, J. and C. Ebrahimi. 1992. Species conservation and monitoring plan for deer fern (*Blechnum spicant*). USDA Forest Service, Northern Region, Idaho Panhandle National Forests, Coeur d'Alene, ID.

Brown, M.R. 2008. Predicting the persistence of a rare forest orchid (*Cypripedium fasciculatum*) under simulated land management. M.A Thesis, University of California, Davis.

Case, F.W. 1987. Orchids of the Western Great Lakes region. Cranbrook Institute of Science. Revised edition.

Chen, J., J.F. Franklin, and T.A. Spies. 1993. Contrasting microclimates among clearcut, edge, and interior of old-growth Douglas-fir forest. *Agricultural and Forest Meteorology* 63:219-237.

Crawford, R.C. 1980. Ecological investigations and management implications of six northern Idaho endemic plants on the proposed endangered and threatened lists. Unpublished thesis, University of Idaho, Moscow. 200 pp.

Evans, D. and Associates. 2005. Conservation assessment of eleven sensitive moonworts (Ophioglossaceae; *Botrychium* subgenus *Botrychium*) on the Idaho Panhandle National Forests. Spokane, Washington.

Farrar, D. 2006. Review of National Forest Region 6 conservation assessment for *Botrychium*, February 28, 2006. Unpublished memorandum to Kathy Ahlenslager, Iowa State University, Ames, IA. 6 pp. (Cited in Ahlenslager and Potash 2007.)

Fulkerson, J.R., M.L. Carlson, and N.C. Vance. 2017. *Cypripedium montanum* (Mountain lady's slipper): Species Assessment on the Tongass National Forest, Alaska Region. USDA Forest Service, U.S. Department of Agriculture, and Alaska Natural Heritage Program, University of Alaska Anchorage. Anchorage, Alaska. 50 pp.

Halpern, C.B. and T.A. Spies. 1995. Plant species diversity in natural and managed forests of the Pacific Northwest. *Ecological Applications* 5(4), pp. 913-934

Harpel, J.A. and L. Holmberg. 2005. Conservation Assessment for *Rhizomnium nudum* (Britt. & Williams) Kop. USDA Forest Service Region 6 and USDI Bureau of Land Management, Oregon and Washington. Updated January 2010 by Camille Duncan (adding photos). 15 p.

Jules, E.S. and B.J. Rathcke. 1999. Mechanisms of reduced *Trillium* recruitment along edges of old-growth forest fragments. *Conservation Biology* 13(4):784-793.

Kaye, T.N. and J.R. Cramer. 2005. Conservation Assessment for *Cypripedium fasciculatum* and *Cypripedium montanum*. Prepared for the USDA Forest Service Region 5.

Keane, R.E., and S.F. Arno. 1993. Rapid decline of Whitebark pine in western Montana: evidence from 20-year re-measurements. West. J. Appl. For. 8: 44-47.

Klinkenberg, Brian. *Dodecatheon dentatum* Hook. White Shooting Star. In Klinkenberg, Brian. (Editor) 2017. E-Flora BC: Electronic Atlas of the Plants of British Columbia [eflora.bc.ca]. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia, Vancouver. [Accessed: 12/09/2018]

Lichthardt, J. 2003. Conservation Strategy for Clustered Lady's Slipper Orchid (*Cypripedium fasciculatum*) in U.S. Forest Service Region 1. Idaho Department of Fish and Game. Conservation Data Center. Boise, Idaho.

1998. Monitoring of Rare Plant Populations on the Clearwater National Forest. Cooperative Challenge Cost-Share Project, Clearwater National Forest and Conservation Data Center, Idaho Department of Fish and Game, Boise. 14 pp. plus appendices.

1995. Establishment of Monitoring Plots for Constance's Bittercress (*Cardamine constancei* Detl.). Idaho Department of Fish and Game. Conservation Data Center. Boise, Idaho.

Lichthardt, J. and R.K. Moseley. 1994. Ecosystem analysis and conservation planning for the Clearwater refugium, Clearwater and Nez Perce National Forests. Unpublished report for the Nez Perce and Clearwater National Forests; on file at Idaho Department of Fish and Game, Conservation Data Center, Boise. 40 pp. plus appendices.

Lorain, C.C. 1991. Species Management Guide for *Grindelia howellii* (Howell's gumweed) on the St. Joe National Forest. Natural Heritage Section, Idaho Department of Fish and Game. Boise, Idaho.

1989. Field investigations of three Region 1 sensitive species on the Clearwater National Forest: *Asplenium trichomanes* (Maidenhair spleenwort), *Thelypteris nevadensis* (Sierra woodfern), and *Dodecatheon hendersonii* (Henderson's shooting star); plus new locations for additional sensitive species. Idaho Department of Fish and Game, Conservation Data Center, Boise. 19 pp. plus appendices.

Matthews, R.F. 1993. *Blechnum spicant*. In: *Fire Effects Information System* [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [accessed 2019, December 4].

Mergen, D.E. 2006. *Cypripedium parviflorum* Salisb. (Lesser yellow lady's slipper): A Technical Conservation Assessment. Prepared for the USDA Forest Service, Rocky Mountain Region Species Conservation Project. Colorado Springs, Colorado. July 17, 2006.

Mills, L.S. 1996. Fragmentation of a natural area: dynamics of isolation for small mammals on forest remnants. In *Natural parks and protected areas*, R.G. Wright (Ed.), pp. 199-219. Blackwell Science, Cambridge, Massachusetts.

Montana Natural Heritage Program (MNHP). 2018. Montana Field Guide. Online. Available: http://fieldguide.mt.gov (Accessed 2017, November 11).

Mousseaux, M., 1998. Idaho Panhandle National Forests Rare Plant Guild Descriptions. Idaho Panhandle National Forests Botanist, Coeur d'Alene, Idaho.

Schofield, W. 1969. Some Common Mosses of British Columbia. B.C. Department of Recreation and Conservation, Victoria, B.C. Canada

Stuckey, I.H. 1967. Environmental factors and the growth of native orchids. American Journal of Botany 54(2):232-241.

USDA Forest Service. 2015. Idaho Panhandle National Forests Land Management Plan. 2015 Revision. Coeur d'Alene, Idaho.

USDA Forest Service. 2012. A Range-Wide Restoration Strategy for Whitebark Pine (*Pinus albicaulis*) RMRS-GTR-279.

USDA Forest Service. 2011. Regional Forester's Sensitive Plant List, Idaho. Region 1, Missoula, Montana.

USDA Forest Service. 2005. Forest Service Manual 2600 – Wildlife, Fish, and Sensitive Plant Habitat Management. Chapter 2670 – Threatened, Endangered and Sensitive Plants and Animals. Chapter 2671 – Cooperation. National Headquarters, Washington DC. Effective: September 23, 2005.

USDA Forest Service. 2002. Conservation Assessment for Green spleenwort (*Asplenium trichomanes-ramosum* L). US Forest Service, Eastern Region.

USDI FWS. 2017. Candidate, Proposed and Listed Species & Proposed and Designated Critical Habitat in Idaho. U.S. Fish and Wildlife Service. Idaho Fish and Wildlife Office. List revised November 6, 2017. Consultation Code: 01EIFW00-2017-SLI-0102

USDI Bureau of Land Management. 1996. Draft Management Recommendations for Green bug moss, *Buxbaumia viridis* (DC.) Moug. & Nestl. Version 1.1.

Zika, P.F., Brainerd, R., and B. Newhouse. 1995. Grapeferns and Moonworts (*Botrychium*, Ophioglossaceae) in the Columbia Basin. Report submitted to the Eastside Ecosystem Management Project, United States Forest Service, Walla Walla, Washington. 126 p.

Appendix A: Sensitive species associated with moist forest

	Species Name	Geographic distribution	G,T,S rank*	Notes regarding habitat requirements, population ecology, threats	Can disturbance be beneficial?
1	***Asplenium trichomanes*** **(Maidenhair spleenwort)**	Interruptedly circumboreal	G5/ S1	Maidenhair spleenwort occurs in moist, rocky, cliff crevices and talus slopes; prefers calcareous rock (Lorain 1989). Threats: "Timber harvest and other habitat-altering activities such as road building and rock quarries pose the most significant threat to maidenhair spleenwort" (Lorain 1989: 4)	NO – see notes regarding habitat alteration
2	***Blechnum spicant*** **(Deer fern)**	Circumpolar, coastal disjunct	G5/ S3	Associated with both early successional and old growth/ climax moist and wet forests (western hemlock, Sitka spruce, western redcedar, Douglas-fir, and Pacific silver fir forests). Appears after disturbances such as windfall, logging. Cover/ distribution changes with changes in stand composition and age (e.g., cover increases in climax stages) (Mathews 1993)	YES – associated with various successional stages
3	***B. lanceolatum*** **var. *lanceolatum* (Lanceleaf moonwort)**	Circumboreal	G5T4/ S3	"With the exception of *B. montanum*… moonworts tend to occur in areas of disturbance that are from 10 to 30 years old. This includes old roads and roadsides, picnic and camping grounds, pastured meadows, avalanche meadows, etc. We seldom find moonworts in abundance under mature old growth forests without recent disturbance." (Ahlenslager and Potash 2007: 34) Moonworts "tend to occur in areas where some mineral soil is exposed or has been exposed within the last 10-30 years. This probably has to do with the ability of arriving spores to percolate into the soil and perhaps also with the establishment and ecology of the appropriate mycorrhizal fungi." (Ahlenslager and Potash 2007: 34) "The recently or periodically disturbed sites that support moonworts have several characteristics in common. They support vegetation that is in an early stage of succession. … They have a generous surface exposure of mineral soil (20% or more). They often have a compacted soil." (Ahlenslager and Potash 2007: 34)	YES – 10-30 year disturbance cycle and evidence of persistence/ presence in compacted soils.
4	***B. lineare*** **(Slender moonwort)**	Circumboreal	G1/ SH		
5	***B. minganense*** **(Mingan moonwort)**	Circumboreal	G4/ S3		
6	***B. paradoxocum*** **(Paradox moonwort)**	Circumboreal	G2/ S1		
7	***B. pinnatum*** **(Northern moonwort)**	Circumboreal	G5/ S2		
8	***B. simplex*** **(Least moonwort)**	Circumboreal	G5/ S2		
9	***Buxbaumia viridis*** **(Green bug-on-a-stick)**	Interruptedly circumboreal	G4/ S2	Rotten stumps/ logs; mineral or organic soil. Cool, shaded humid locations at middle elevations. Closed canopy provides necessary microclimate for species occurring on decaying wood and humic duff. "Shelterwood and thinning prescriptions for timber harvest may impact populations, as logs dry out under the changing microclimate regime" (USDI 1996: 5). BUVI requires "continued input of coarse woody debris in various decay classes and diameters as a substrate" (USDI 1996: 5). "Maintain decay class 3, 4, and 5 logs, leaving windfalls in place to provide structurally diverse habitat and maintain a dense overstory to maintain humidity (< 70% closed canopy)" (USDI 1996: 2).	NO – see notes

10	***Cardamine constancei*** **(Constance's bittercress)**	Endemic to northern Idaho	G3/ S3	Micro-sites appear to be important in protecting relict populations (in 70-100 year-old stands). "From these relict populations the species may expand as forest succession proceeds." (Lichthardt and Moseley 1994) Changes to canopy cover has variable results: although increased light stimulates flowering and perhaps production of ramets, direct sun following canopy removal causes mortality to plants. Limited genetic variability at intra-population level (due to predominant clonal propagation and small, reproductively-isolated populations)	POSSIBLY – see notes
11	***Cypripedium fasciculatum*** **(Clustered lady's slipper)**	Sparsely distributed within broad range spanning mountainous areas of eight western states	G4/ S3	*General habitat conditions:* in northern Rocky Mountains, this species is associated with coniferous forest or inclusions within coniferous forests. Some degree of shade required, although this may range from deep or partial shade to dappled sunlight. See Brown (2008) for a discussion of the potential significance of different types of shade created by conifers, drier site shrubs, and broader-leaved shrubs associated with moister-habitat conditions, such as Pacific dogwood, for Sierra Nevada occurrences of *Cypripedium fasciculatum*. Soil conditions: Lichthardt (2003: 8-9) observes that while CYFA may be a habitat generalist, as with all orchids, it requires the presence of an organically-enriched O horizon with healthy mycorrhizal networks (i.e., its roots are colonized by hyphae of symbiotic soil fungi). It is typically associated with forest floors with layers of litter and duff. Because of its reliance on mycorrhizae, CYFA is very vulnerable to, and unlikely to survive, direct soil disturbance. *Habitat:* in northern Idaho and western Montana, "[f]orest structure and composition have largely resulted from past fires (Lichthardt 2003: 6). Associated habitat types in northern Idaho (western Montana) include both dry and moist forest (Lichthardt 2003: 7, 9). Dry forest sites are characterized by Douglas-fir/ ninebark and grand fir/ ninebark habitat and shorter disturbance cycles: 10-30 year cycles of fire. In the case of CYFA associated with dry forest habitat, Lichthardt (2003: 9) observes that the more densely stocked forests and greater canopy cover associated with the past 50 years of fire suppression may negatively impact suitable habitat by increasing the chances of a stand-replacing fire. Moist forest habitats typified by Western redcedar (and including western hemlock and grand fir) historically experienced longer disturbance intervals: 75-100 year underburn cycles and 150->200 year cycles for stand-replacing fires. Lichthardt (2003: 17) suggests that increasing stand age and development may contribute to the development of habitat for CYFA and, citing Harrod (personal communication), further suggests that CYFA "may be thriving in some areas under conditions of fire suppression. As stands age, they become patchy and multilayered, allowing more light to the forest floor and building up deeper duff layers and rotted wood that provide a medium for a rich fungal network." Moist forest habitat CYFA occurrences in this region are either mid-seral, or, more frequently, late-seral (Lichthardt 2003: 7) Fire: The direct impacts of fire to existing individual plants will vary depending on fire intensity. Specifically, if the fire temperature is moderate and the duff layer is left somewhat intact, the underground portion of the plant may survive; more intense fires will kill existing plants.	NO – occurrences typically associated with mid- or, more frequently, late-seral stands. See Lichthardt's (2003: 7) discussion of important light and soil elements of late-seral stands.

12	***Grimmia brittoniae* (Britton's grimmia moss)**	Narrow endemic – western Montana and northern Idaho	G2/ S2	Threats for one Montana population include road widening, which may affect cliff face upon which moss grows (MNHP 2017)	NO – narrow microhabitat adaptation
13	***Mimulus alsinoides* (Chickweed monkeyflower)**	British Columbia south to Idaho and northern California	G5/ S1	Vernally moist rocky cliffs (Klinkenberg 2017)	NO – given microhabitat adaptation; however, more data necessary
14	***Rhizomnium nudum*** **(Naked mnium moss)**	Amphi-beringian distribution.	G4/ S1	Moist, coniferous forests. Associated with mature, stable stands (i.e., lacking disturbance); riparian areas (low gradient) (Harpel and Holmberg 2005) Narrow environmental specificity: moist, but not wet, substrates; can be along streams or by persistent snowpack	NO – see notes
15	***Waldsteinia idahoensis* (Idaho barren strawberry)**	Narrow endemic	G3/ S3	Habitat includes moist grand fir forests under closed canopy and in forest openings. Canopy opening may increase reproduction in the short-term; low-intensity fire will not affect the species (Crawford 1980).	POSSIBLY – more data necessary

Appendix B: Sensitive species associated with sub-alpine environments

	Species Name	Geographic distribution	G,T,S rank*	Notes regarding habitat requirements, population ecology, threats	Can disturbance be beneficial?
1	***Buxbaumia aphylla* (Leafless bug-on-a-stick)**	Widely distributed in the northern hemisphere	G5/ S1	In North America, this moss is a pioneer of disturbed, acid, sandy or clayey soils. Associated with road banks and forested trails and old logs and stumps. Found in both well-lit and partly shady areas in moist forests and dry, open woods. It is often successional to fire. (NatureServe 2019, citing Crum and Anderson 1981)	YES – successional to fire and associated with road banks and trails
2	***Pinus albicaulis* (Whitebark pine, WBP)**	Western North America	G3?/ S3	Found in upper sub-alpine forests/ timberline Threatened by various factors: disease (white pine blister rust, mountain pine beetle), succession resulting from fire suppression, and climate change decreasing available suitable habitat. These factors interact with each other and also certain life history traits (delayed age at maturity, low dispersal rate, reliance on a single dispersal agent [Clark's nutcracker]). Can recolonize burned areas: Clark's nutcracker appears to prefer open sites for seed caching. (Keane 1999; NatureServe 2019) Although fire can be a tool to restore WBP habitat, it can burn too severely, resulting in the death of any existing trees. Measures such as wrapping trees with fire shelter material, removing fuels (canopy and surface) away from trees, and burning under moist conditions (may need to burn twice) are therefore recommended (Keane 1999; NatureServe 2019).	YES – fire and vegetation removal can be used to create conditions suitable to WBP and appealing for seed caching by its seed disperser, Clark's nutcracker
3	***Triantha occidentalis* ssp. *brevistyla* (Sticky asphodel [short-styled])**	In western North America, from southern Alaska to Vancouver Island/ Olympic Mountains and from B.C. south through the Cascades to southern Oregon and east to southeastern B.C. and the Selkirk Mountain range.	G5T5/ S1	Generally associated with wet meadows, streambanks, and bogs – as well as on moist alpine ridges (Slichter 2008). On the Idaho Panhandle National Forests, this species is associated with sub-alpine peatlands. No information regarding threats to this taxon was found; NatureServe has not yet conducted an assessment. However, in the case of a related species, Coastal false asphodel (*Triantha racemosa*), found in the eastern U.S., NatureServe (2019) describes alteration of hydrology and consequent loss of habitat as a threat. Given that Sticky asphodel is also associated with wetlands (specifically, peatlands on the IPNF), alterations to hydrology may also pose a threat to this taxon. (Slichter, Paul. 2008. *Columbia River Gorge Wildflowers: From Bonneville East*. Online resource: http://science.halleyhosting.com/nature/gorge/index.htm [accessed March, 2019])	LIKELY NO – although species-specific data are lacking, see notes

Appendix C: Degree of effects from typical forest management activities

Action	Cumulative effects	Comments
Silvicultural treatment: Regeneration harvest (even-aged management)	Moderate	Regeneration harvest (also called even-aged stand management) results in removal of most of the canopy (~90%), leaving only select scattered trees and groups of trees. Because of substantial changes to air/ soil temperature and humidity (increased solar insolation, higher soil/ air temperature, reduce soil/ air humidity) following this type of disturbance, the resultant plant community is dominated by early seral stage species. The risk of direct and indirect effects to sensitive plants and their habitat is **moderate**. Individuals may be damaged by too much sun, wind, and higher temperatures and/ or habitat capability for mid- to late-seral species is reduced in the short term.
Silvicultural treatment: Commercial thinning (un-even aged stand management)	Low to moderate	Commercial thinning removes a smaller percentage of the canopy cover; as a result, solar insolation does not increase substantially and habitat conditions following treatment are similar to pre-treatment conditions (i.e., there is a much lower risk of conversion to an early seral stage plant community). Consequently, this treatment type poses a **low to moderate** risk of direct and indirect impacts to moist forest species and their habitat. Moreover, effects to habitat from commercial thinning are shorter-term than for regeneration harvest.
Yarding mechanism: Ground-based yarding	Moderate to high/ low to moderate	Ground-based yarding (e.g., tractor yarding, tractor with line pulling) typically involve yarding (skidding) corridors every 50 to 100 feet. Trees are felled in the corridors and then equipment moves (yards) trees to landings, where they are placed onto log trucks. Unless this type of yarding takes place on frozen ground, there is a **moderate to high** risk of soil disturbance, displacement, and compaction and therefore of direct effects to sensitive plant individuals. If ground-based yarding takes place on frozen ground, then the risk of damage/ destruction of sensitive plants may be reduced to **low to moderate**.
Yarding mechanism: Skyline yarding	Low	Skyline yarding results in **low** effects on sensitive plants—as direct impacts may be less likely and/ or less intense (e.g., trampling plants, rutting soil, soil compaction) than for ground-based yarding.
Winter harvest (i.e., on frozen soils)	Low	In the case of operation of machinery on snow or frozen soils, impacts would be less intense (with respect to rutting and compaction of soil) and the chances of trampling/ destroying plants less likely (many plants are underground during winter) than on unfrozen ground. Winter harvest would result in **low** cumulative effects to sensitive plants.
Pre-commercial timber stand improvement	Very low	Pre-commercial timber stand improvement entails pruning and thinning young trees prior to canopy closure. As a result of these activities, the time it takes for stands to reach canopy closure (which provides critical shade for some moist forest sensitive plant species) increases. Because the magnitude of change to canopy cover is so slight and the effects do not last long (less than 10 years), the cumulative effects to sensitive plants are considered **very low**.
Prescribed burning for site preparation & fuels treatment	Low to moderate	Potential effects to sensitive plants and their habitat from prescribed burning depend on a range of variables, including the timing and severity of fires, phenology of plants at the time of the fire, type of habitat and associated plant species, and the use of ground-based activities related to prescribed fires. Overall, cumulative effects from prescribed burning and associated activities range from **low to moderate**. Direct impacts can include damage or destruction of individual plants from fire (the aboveground portion and, in cases of severe fire, to soil and also plant underground structures), which can reduce population vigor or cause a decline in population. Direct impacts can also result from machine (grapple) piling of slash/ debris and the construction of fire-lines – similar to ground-based timber harvest activities. Indirect impacts to sensitive plant habitat result from changes to canopy cover and the forest floor. The degree of canopy removal can vary depending on the severity of the fire, which is partly shaped by soil and vegetation conditions (relative humidity/ temperatures, fuel loading). Very severe fires can remove most or all of the vegetation and scorch soils, causing longer-term impacts to habitat. Additionally, some species require specific substrates or habitat conditions, including a litter/ duff layer and coarse woody debris; these may be lost in more severe fires. Design features developed to reduce effects to soils (e.g., requiring that some coarse woody debris remain or that grapple piles be smaller/ more rather than bigger/ few) can minimize the risks of bare mineral soil exposure and severe soil disturbance.

		The timing of fires relative to plant phenology is also important: fires occurring before or after spore maturity or seed dispersal pose a lower risk to sensitive plants' persistence. The role of fire in a particular ecosystem also shapes the degree of risk to associated sensitive plant species. In northern Idaho, dry forest guild sensitive species are adapted to a cycle of more frequent wildfires; by contrast, moist forest sensitive species, which are associated with mid- to later-seral states, are more vulnerable to the impacts of fire to their habitat (i.e., causing loss of elements of the more mature stands).
Tree planting	Very low	Tree planting causes soil disturbance and may affect individual, undetected, sensitive plant occurrences (documented occurrences would be protected by spatial buffers). However, the scale of any such impact would be very small and would result in a **very low** cumulative effect to sensitive plants (i.e., no measurable effect).
Road construction and decommissioning	Low to moderate	Past road construction in the project area has likely affected sensitive plants and their habitat due to the soil disturbance and removal of canopy cover associated with this activity. Additionally, the machinery used in road construction, and the vehicles driven subsequently, have resulted in the introduction of non-native, invasive plant species (weeds), which have further altered the habitat in these areas. Consequently, these activities are considered to have a **low to moderate** cumulative effect on sensitive plants.
Road maintenance and storage	Low	The potential effects of road maintenance and storage are similar to those for road construction and decommissioning, except that the scale of disturbance is much smaller and no new area is being disturbed. Consequently, these activities have a **low cumulative effect** to sensitive plants.
Fire suppression	Low	Some activities associated with fire suppression could impact sensitive plants as a result of direct injury/ mortality or soil disturbance (e.g., fireline construction, back-burning). Such impacts would have a **low** cumulative effect to sensitive plants.
Trail construction and maintenance	Very low to low	Trail construction results in soil disturbance, but because the scale of the activity is so limited, effects would be restricted to individual sensitive plants or small sub-populations. Consequently, the cumulative effects to sensitive plants would be **low**. Trail maintenance involves even more restricted scale of disturbance, such that the cumulative impacts would be **very low**.
Weed treatment	Low	Ongoing chemical weed treatments focus on roadside weeds. Herbicides can damage or kill plants other than the target weeds and can linger in soil for variable periods of time, although the spatial scale of potential impacts are localized. Typically sensitive plants are not associated with disturbed habitats like roads; exceptions include a few disturbance-tolerant species like Howell's gumweed and several of the Moonwort species. In the case of the Moonworts, certain species are often found along older road prisms (*Botrychium lanceolatum* ssp. *viride* and *B. pinnatum*). These species would be at greater risk of effects from weed treatments. However, because few sensitive plant species occur in treatment areas and because the spatial scale of impacts is restricted, the overall cumulative effects to sensitive plants would be **low**.
Wildfires	Low to high	Wildfires can result in changes to canopy cover and soil disturbance. Past fire suppression increases the likelihood of more intense wildfires in the future, resulting in more intense soil disturbance and changes to canopy cover. Consequently, cumulative effects to sensitive plants from wildfires can range from **low to high**.
Public activities like firewood collection, camping, hunting, hiking, picking berries	Very low to low	Small-scale soil disturbance and removal of forest canopy may result from public activities like cutting and skidding firewood and vehicle use. Trampling and/ or picking of flowers may also occur. Overall, the scale of these activities is very small, such that potential effects would have **very low to low** cumulative effects on sensitive plants.